



## Analysis of *Escherichia Coli* Existence Factors in Street Food at Primary School in Ngrogot District

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### Abstract

Food availability and security are basic human rights. Lack of attention to food security such as unhygienic food processing can cause health problems. National Food and Drug Agency stated that 27.92% of school children snacks contain hazardous substances ranging from physical, chemical and microbiological. The survey results of 36 primary schools in the Ngronggot District do not have the criteria for a healthy canteen, it causes the access of street food are increase freely in the Primary School environment. Most of them didn't have a food production legacy from Health Office or National Food and Drug Agency. The purpose of this study was to determine the most dominant factors among other factors, namely environmental sanitation, sanitation equipment, food handler personal hygiene, the condition of food raw materials, the condition of food storage, and the condition of serving food to the presence of *E. coli*. This research was quantitative method, with cross sectional approach. The research sample was 48 samples with simple random sampling technique. The instrument used was observation sheets and laboratory test results. Data collection techniques used interviews, observations and laboratory tests. Statistical analysis used Multiple Logistic it is found that the most dominant variable among the other variables is food handler personal hygiene = 0.003. The presence of *E. coli* indicates microbial contamination in food which results in food borne illness. It is recommended to increase supervision in food processing to reduce bacterial contamination.

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## INTRODUCTION

Food availability and security is a basic human right, it is stated in Law No. 36 of 2009. Lack of attention to food security such as unhygienic food from the process of preparation to presentation can cause health problems (Ministry of Health, 2011).

*Escherichia coli* or commonly abbreviated as *E. coli*, this bacterium is chosen as an indicator of contamination of water or food. The presence of *E. coli* shows a sign of poor sanitation practices because *E. coli* can move by hand to mouth activity or by passive transfer through food, water, milk and other products. *E. coli* is found in foods or drinks that enter the human body and can cause symptoms such as cholera, dysentery, gastroenteritis, diarrhoea and various other gastrointestinal diseases (Kurniadi, et al., 2013) *E. coli* bacteria are considered as indicators of faeces organisms, where the relationship with diarrheal disease is very close (Gruber, et al., 2014).

National Food and Drug Agency states that 27.92% of school children's snacks contain hazardous ingredients in form of physical, chemical, and microbiologic (BPOM, 2010). Indonesian health data in 2015 also shows that the number of diarrhoea cases in East Java Province was ranked second after the West Java province. There are 1,048,885 cases of diarrhea in health facilities. Based on the health profile data of East Java province, Nganjuk Regency is one of the regions in East Java Province that have high case of diarrhoea of 22,293 people (Kemenkes, 2017).

The results of a preliminary study in the Ngronggot area, diarrhoea cases are increase significantly from 2016 amounting to 1,689 cases to 1,923 cases in 2017. The survey results of all state elementary schools in Ngronggot district shows that most school did not have the criteria of healthy canteen. So that the access of street food is free to sell food. It does not rule out the possibility that the food sold is self processed by the seller where there is no distribution permit for production from the local Health Office or from the National Food

and Drug Agency. The results of the interviews and observations on 10 street food who sell in some state elementary schools found that the sellers sell are *cilok* (made from starch), *siomay*, topped eggs, fried noodles, *pecel*, and meatballs. All these foods are processed by themselves. From the observation, only 2 traders wore aprons while touching food but did not rule out the possibility that from 10 street food, hygiene and sanitation of food did not fulfil the requirements, it was seen that the condition of trash bin was still open, not washing hands when touching food, washing tools did not meet the requirements, and the trash bin is still open.

The purpose of this study was to analyze the effect of environmental sanitation, sanitation equipment, food handler personal hygiene, and conditions of raw food materials, food storage conditions, conditions for serving food and the presence of *E. coli* bacteria in street food snacks in at Ngronggot Elementary School of Nganjuk.

## METHOD

The study was conducted using cross sectional approach. The populations of street food in Ngronggot District Elementary School are 69 people. The sample in this study was obtained by calculating using the *Lamshow* formula, which is 48 samples using the simple random sampling technique.

The independent variables in this study include environmental sanitation, sanitation equipment, food handler personal hygiene, conditions of raw food materials, conditions for storing ready-to-eat food, and conditions for serving food. Whereas for the dependent variable is the presence of *Escherichia coli* bacteria. The instrument in this study used observation sheets and laboratory test results form. Data collection techniques in this study were conducted by interviews, observations and laboratory tests

In this study multivariate analysis was conducted to see the most influential factors among the other factors in the independent

variable and the dependent variable using the Multiple Logistic Regression test.

## RESULT AND DISCUSSION

This research was conducted in the Ngronggot District Primary School in Nganjuk Regency, in October-November 2018 with the aim to find out the most influential factors among other factors with the presence of bacteria on snack and foods through laboratory testing using *Most Probable Number*.

### Univariate Analysis

**Table 1.** Frequency Distribution of Affecting Factors of *E. coli* bacteria Existence.

Variable	Category	Frequency	Percentage
Environmental Sanitation	Ineligible	15	31.2
	Eligible	33	68.8
Tools Sanitation	Ineligible	13	27.1
	Eligible	35	72.9
Personal Hygiene of food handler	Ineligible	12	25.0
	Eligible	36	75.0
Condition of raw food materials	Ineligible	16	33.3
	Eligible	32	66.7
Food Storage	Ineligible	14	29.9
	Eligible	34	70.8
Food serving	Ineligible	15	31.2
	Eligible	33	68.8
<i>E.coli</i> Bacteria's existence	Ineligible	15	31.2
	Eligible	33	68.8

Table 1 show that environmental sanitation category does not meet the requirements of 5 street food s (31.2%). On the results of observations, the trash basket is not in accordance with the stipulated conditions, the trash basket is still open so that many insects fly in the location. A similar study was carried out on street food paddlers that sell *Tempe Penyet*, the location of selling close to sources of pollution. In addition, this location is near traditional markets, where the potential for food to be polluted by garbage and water is quite large (Agustin, *et al.*, 2008)

Equipment sanitation category does not meet the requirements of 13 street food (27.1%) because the behaviour of the seller is not in

accordance with the stipulated conditions. Based on other studies, it was stated that from 26 respondents (56.5%) sanitation equipment did not meet the requirements for quality standards, which were found > 100 bacterial colonies / cm<sup>2</sup> (Fadhila, *et al.*, 2015).

Personal hygiene of food handler category did not meet the requirements of 12 traders (25.0%) due to not washing their hands with soap when handling food, sneezing, smoking, not wearing aprons when serving buyers, this finding is accordance to a research held by Kumalasari (2016). In personal hygiene several things that need to be considered is personal hygiene from the tip of the hair to the tip of the foot. This has an effect because healthy food handlers will produce quality food (Auliya, *et al.*, 2016)

The condition of food raw materials in the category is not fulfilling the requirements of 16 traders (33.3%), it was due to the fact that many raw materials were not registered and licensed, and the condition of the raw materials obtained was kept open so that many flies perched due to after raining. Similar research on the condition of food raw materials, namely chicken meat obtained in traditional markets, the cleanliness of chicken meat is still lack because there is still shoot feathers, besides the sellers do not use gloves to maintain cleanliness of chicken meat (Sartika, *et al.*, 2016) .

The conditions for food storage category does not meet the requirements of 14 street food (29.9%) where the results of observing the conditions of food storage is open, does not use a closed window, and the cleanliness is not in accordance with the provisions. The research exclaims that there is still much food storage in the form of window displays that do not meet the requirements of more than 80% (Nuraya, *et al.*, 2017).

The food serving conditions category did not meet the requirements of 15 traders (31.2%), because seller served the food in outdoor place so it can be contaminated by dust and insects. Previous research also stated that the habit of sellers who can cause contamination in food was the use of

newspaper or plastic cover which can trigger contamination in snack foods (Kurniadi, et al., 2013).

The presence of *E. coli* bacteria category does not meet the requirements as many as 15 samples (31.3%), which means that food samples are contaminated by *E. coli* above the required standard of threshold value. The results of similar studies found *Coliform* bacterial as species of *E. coli*, *Salmonella*, and *Aureus Sp.* found in chicken sausage snacks sold around Flamboyan Market, Pontianak City (Kartika, et al., 2014).

**Bivariate Analysis**

In bivariate analysis, the relationship between independent variables and variables is bound using the fisher's exact test. In table 2 explains that the environment sanitation variable with p-value 0,000 is obtained, which means that there is a significant relationship to the presence of *E. coli* bacteria in foods. A similar study on environmental sanitation stated that the environmental conditions of street food who did not fulfil their food requirements had 16 times risk of *E. coli* compared to environmental conditions that did not meet the requirements (p = 0.001), which meant there was a close relationship between environmental sanitation and *E. coli* bacteria in food (Riyanto, et al., 2012)

**Table 2.** Result of Crosstab Test between Environmental Sanitation, Tools Sanitation, *Personal Hygiene* of street food, Condition of raw food materials, Food Storage Condition, Food serving Condition.

Variable		The existence of <i>E.coli</i> bacteria.				P value
		Ineligible	%	Eligible	%	
Environmental Sanitation and the existence of <i>E.coli</i> bacteria.	Ineligible	11	22.9	4	8.3	0.000
	Eligible	4	8.3	29	60.4	
Tools Sanitation and the existence of <i>E.coli</i> bacteria.	Ineligible	13	27.1	0	0	0.000
	Eligible	2	4.2	33	68.8	
Personal Hygiene of food handler and the existence of <i>E.coli</i> bacteria.	Ineligible	10	20.8	2	4.2	0.000
	Eligible	5	10.4	31	64.6	
Condition of raw food materials and the existence of <i>E.coli</i> bacteria.	Ineligible	11	22.9	5	10.4	0.000
	Eligible	4	8.3	28	58.3	
Food Storage Condition and the existence of <i>E.coli</i> bacteria.	Ineligible	12	25.0	2	4.2	0.000
	Eligible	3	6.3	31	64.6	
Food serving Condition and the existence of <i>E.coli</i> bacteria.	Ineligible	11	22.9	5	10.4	0.000
	Eligible	4	8.3	28	58.3	

Equipment sanitation has a p-value of 0,000, which means that there is a significant relationship between equipment sanitation and the presence of *Escherichia coli* bacteria. A similar study stated that washing a dish with improper manner will affect the number of colonies of food germ equipment of 1.651 times greater than those who have washed eating utensils that are eligible (Suryani, 2014)

Personal hygiene of food handler has a p-value of 0,000 which means that there is a relationship between personal hygiene of food handler and the presence of *E. coli* bacteria in food. A similar study stated that between personal hygiene practices and the presence of *E. coli* bacteria there was a significant relationship with a p-value of 0.033 (Rachmawati, *et al.*, 2015).

The condition of food raw materials has a p-value of 0,000, which means that there is a relationship between the condition of food raw materials and the presence of *E. coli* bacteria in foods. A similar study on the condition of the food raw material of street food who did not meet the requirements had a risk of 3.1 times contaminated by *E. coli* compared to those who fulfilled the requirements, where there was a significant relationship between the condition of food raw materials containing *E.coli* in food (Riyanto, *et al.*, 2012).

The storage conditions of processed food have a p-value of 0,000, which means that there is a significant relationship between the condition of storage of processed food and the presence of *E. coli* bacteria. One similar study also stated that most storage places for 17 food stalls (56.7%) had bad categories. After analysis, it was stated that there was a significant relationship between the condition of the food storage and the presence of *E. coli* bacteria which had a positive value of 11 (36.7%) (Bestari, *et al.*, 2016).

Food serving conditions have a p-value of 0,000 which can be interpreted that there is a significant relationship between the conditions of food serving with the presence of *E. coli* bacteria in food. Another study said that from observations of containers in serving *Pecel* used

banana leaves (26%) where banana leaves did not meet health requirements, while in stalls seller, the hand of the seller had direct contact with *Pecel* (83%) and other ingredients that could cause bacterial contamination directly through food sellers (Sembiring, *et al.*, 2015).

### Multivariate Analysis

Multivariate analysis used the *Multiple Logistic Regression* test which went through several stages. In table 3 the results of *Simple Logistic Regression* analysis variables that influence the presence of *E. coli* bacteria are environmental sanitation, personal hygiene of street food, raw material conditions, food standards,

**Table 3.** Simple Regression Logistic Test

Variable	<i>P</i> – value of	
	<i>Escheria</i>	<i>coli</i>
	<i>Bacteria</i>	
Environmental Sanitation	0.000	
Tools Sanitation	0.998	
Personal Hygiene of food handler	0.000	0.000
Condition of raw food materials	0.000	0.000
Food Storage Condition		
Food serving Condition.		

food storage conditions, food serving conditions with a p-value of 0,000. Whereas equipment sanitation has a p-value of 0.998, which means there is no influence between sanitation of equipment and the presence of *E. coli* bacteria.

**Table 4.** Final Model of Multiple Logistic Regression Tests

Variable	B	<i>P</i> value	OR	95%CI	
				Lower	Upper
Environmental Sanitation	2.724	0.005	15.244	2.296	101.194
Personal Hygiene	3.164	0.003	23.674	2.926	191.521

In table 4, the results of logistic regression analysis can be seen when all variables have p values <0.05, so the modelling has been completed. The variable that has the most dominant influence on the presence of *Escherichia coli* bacteria on foods is personal hygiene of food handler, this can be seen from the OR value, it has the highest of other OR value of other variables namely OR = 23,674. This means that personal hygiene of food handler has a chance of 23,674 times contaminated by *E. coli* bacteria in food compared to other variables. This is due to the observation that the habits of street food and how to touch food do not meet the applicable requirements.

In a previous study, the assessment of the hygiene of chicken noodle street food included hand washing habits, holding money, healthy / sick condition of sellers, and not talking when serving chicken noodles when they are sick. When examining the relationship between street food hygiene and germ on chicken noodles obtained a p-value of 0.036, it means that there is a relationship between personal hygiene of food handler and the number of germs on chicken noodles (Vitria, *et al.*, 2013). Other studies reveal that food sellers must meet the criteria of healthy individuals, where they do not suffer from any disease, must routinely check-up, maintain cleanliness, and carry out appropriate treatment (Ucar, *et al.*, 2016).

A similar study also mentioned that there was a significant relationship between personal hygiene and *E. coli* contamination on food with a p-value of 0.002. After further analysis, it was obtained OR = 25,200 which means that personal hygiene of street food does not have a chance of 25,200 times for *E. coli* contamination in food compared to good personal hygiene of street food (Yunus, *et al.*, 2015).

## CONCLUSION

The conclusions in this study can be taken as follows: Factors that influence the

presence of *E. coli* bacteria in foods are environmental sanitation, personal hygiene of food handler, food raw material conditions, food storage conditions, food serving conditions. In the subsequent analysis, personal hygiene of food handler was the most dominant factor among other factors.

## REFERENCE

- Agustin, T.E, Adriyani, R. 2008. "Higiene Dan Sanitasi Tempe Penyet Pedagang Kaki Lima Jalan Karangmenjangan." *Jurnal Kesehatan Lingkungan* 4(2)(Januari 2008): 69–80.
- Auliya, A., and D. Aprilia. 2016. "Pengaruh Higiene Pengolahan Makanan Terhadap Kualitas Makanan Di Hotel Aston Rasuna Jakarta." *Jurnal Hospitality dan Pariwisata* 2(2)(November): 216–27.
- Bestari, H., W.B.S Joseph, and B.T Ratag. 2016. "Hubungan Antara Sumber, Sanitasi Tempat Penyimpanan Dan Higiene Penjamah Makanan Dengan Keberadaan Escherichia Coli Pada Es Batu Di Warung Makan Kawasan Boulevard Kota Manado." 5(1).
- Fadhila, M.F, N.E Wahyuningsih, and Y Hanani. 2015. "Hubungan Higiene Sanitasi Dengan Kualitas Bakteriologis Pada Alat Makan Pedagang Di Wilayah Sekitar Kampus UNDIP Tembalang." *Jurnal Kesehatan Masyarakat* 3(3)(April): 769–76.
- Gruber, J.S, A\ Ercumen, and J.M Colford. 2014. "Coliform Bacteria as Indicators of Diarrheal Risk in Household Drinking Water: Systematic Review and Meta- Analysis." *Plos One* 9(9).
- Kartika, E, S Khotimah, and A.H. Yanti. 2014. "Deteksi Bakteri Indikator Keamanan Pangan Pada Sosis Daging Ayam Di Pasar Flamboyan Pontianak." *Protobiont* 3(2): 111–19.
- Kemkes,RI., 2011. Peraturan Menteri Kesehatan Republik Indonesia Nomor 1096/MENKES/PER/VI/2011 tentang Higiene Sanitasi Jasaboga.

- Kemenkes, RI., 2017. *Profil Data Kesehatan Negara Indonesia 2016*. Jakarta
- Kumalasari, R.C. 2016. "Hubungan Sanitasi Dengan Status Bakteriologi (Status Koliform Dan Keberadaan Salmonella Sp) Pada Jajanan Di Sekolah Dsar Wilayah Kecamatan Tembalang, Semarang." *Jurnal Kesehatan Masyarakat* 4(3)(April): 98–107.
- Kurniadi, Y., Z. Saam, and D. Afandi. 2013. "Faktor Kontaminasi Bakteri E.coli Pada Makanan Jajanan Dilingkungan Kantin Sekolah Dasar Wilayah Kecamatan Bangkinang." *Jurnal Ilmu Lingkungan* 7(1): 28–37.
- Nuraya, A.D, and T.S Nindya. 2017. "Hubungan Praktik Personal Hygiene Pedagang Dengan Keberadaan Bakteri Escherichia Coli Dalam Jajanan Kue Lapis Di Pasar Kembang Kota Surabaya." *Media Gizi Indonesia* 12(1)(Januari-Juni): 7–13.
- Rachmawati, R., P.T. Ningrum, and R.S. Pujiati. 2015. "Praktik Higiene Personal Dan Keberadaan Bakteri Escherichia Coli Pada Tangan Penjamah Makanan ( Studi Pada Pedagang Kaki Lima Di Jalan Kalimantan Kecamatan Sumbersari Kabupaten Jember )." *Artikel Hasil Penelitian Mahasiswa Universitas Jember*.
- Riyanto, A., and A. Abdillah. 2012. "Faktor Yang Memengaruhi Kandungan E . Coli Makanan Jajanan SD Di Wilayah Cimahi Selatan." *MKB* 44(2): 77–82.
- Sartika, D., M. Erna, and L. Marliena. 2016. "Survei Cemaran Mikroba Dan Mutu Daging Ayam (Gallus Gallus Domesticus) Segar." *Jurnal Kelitbangan* 4(2): 162–80.
- Sembiring, G.G, S. Dharma, and I. Marsaulina. 2015. "Penilaian Higiene Dan Sanitasi Penjualan Makanan Pecel Dan Pemeriksaan Bakteri Salmonella Di Kecamatan Medan Helvetia." *Artikel Hasil Penelitian Mahasiswa Pascasarjana Universitas Sumatra Utara*.
- Suryani, D. 2014. "Keberadaan Angka Kuman Ikan Bawal Bakar Dan Peralatan Makan Bakar." *Jurnal Kesehatan Masyarakat* 9 (2)(9): 191–96.
- Ucar, A, M.V Yilmaz, and F.P Cakiroglu. 2016. "Food Safety – Problems and Solutions." 19(April): 9–15.
- Vitria, D. Elnovriza, and Azrimaidaliza. 2013. "Hubungan Higiene Sanitasi Dan Cara Pengolahan Mie Ayam Dengan Angka Kuman Di Kota Padang." *Jurnal Kesehatan Masyarakat* 7(2)(Maret-September): 75–81.
- Yunus, S.P., J.M.L. Umboh, and O. Pinontoan. 2015. "Hubungan Personal Higiene Dan Fasilitas Sanitasi Dengan Kontaminasi Escherichia Coli Pada Makanan Di Rumah Makan Padang Kota Manado Dan Kota Bitung." *JIKMU* 5(2)(April): 210–20.